



National Aeronautics and  
Space Administration  
**Langley Research Center**  
Office of Education

Educator's Guide

Teachers &  
Students

Grades K-8

# CONNECT

VIDEO SERIES

# Earth from Space



Earth from Space is a partnership between WVEC-TV Channel 13,  
Portsmouth Public Schools, and NASA Langley Office of Education

Program 3 of 4  
Publication Number  
EG-1998-01-20-LaRC

## Background (Pgs. 1–4)

- Introduction to CONNECT Series
- Introduction to CONNECT 3: Earth from Space
- NASA's Contribution to Earth Science

## Program Guide Contents

## Program Partners

- Portsmouth Public Schools
- WVEC-TV, Channel 13

## Need More Copies?

## Section 1

This section contains valuable information concerning the CONNECT Series and *Earth from Space*, Program 3 of the CONNECT Series. This information will allow educators to become familiar with the purpose of the CONNECT Series and the *Earth from Space* program and to understand the Earth Science mission of the National Aeronautics and Space Administration (NASA).

**Section 1:** Series Overview and Program Format (pgs. 1–4)

**Section 2:** Program Preparation (pgs. 5–9)

**Section 3:** Program Viewing and Exploration (pgs. 10–20)

**Section 4:** Classroom Lesson Plan (pgs. A1–A9)

**Section 5:** Home Connection (pgs. A10–A13)

The *Earth from Space* program is a collaboration between NASA Langley's Office of Education, WVEC-TV Channel 13, and the Portsmouth Public Schools. These partners share in their commitment to education and children and proudly present this CONNECT program to the educational community.

We encourage the widest possible distribution and use of our educational programs and materials. Specifically, there is no claim of copyright by the U.S. Government concerning the CONNECT Series. Therefore, our permission is not required to either tape each broadcast or to copy the associated print materials for classroom use and/or retention in your school's library.

## NASA Strategic Plan

identifies "Educational Excellence" as one of its strategic outcomes and states:

*"We involve the education community in our endeavors to inspire America's students, create learning opportunities, and enlighten inquisitive minds."*

## NASA – Investing in America's future through excellence in education

NASA is committed to promoting excellence in education, to supporting the teaching profession, and to increasing the awareness of the impact science, mathematics, and technology will have on the quality of life in the 21st century.

**Call-In**  
(for broadcast date only):  
864-3991 (local) or  
1-888-835-0026 (toll free)

**E-Mail:**  
connect@edu.larc.nasa.gov

**Web Site:**  
<http://edu.larc.nasa.gov/connect/>

## INTRODUCTION TO THE CONNECT VIDEO SERIES

The CONNECT Video Series consists of four, 30-minute interactive programs delivered to both K-4 and 5-8 audiences. Each program in the series will feature one of the four NASA Strategic Enterprises. It is this "content" that drives the uniqueness of the CONNECT programs. The Enterprises include Aeronautics and Space Transportation Technology, Earth Science, Human Exploration and Development of Space, and Space Science.

## SERIES OBJECTIVES

- Demonstrate the connection between the concepts and skills taught in the classroom and their application in the workplace.
- Address specific national mathematics standards and support state curriculum frameworks and standards.
- Actively engage students in problem solving, mathematical reasoning, and communicating mathematics.
- Build activities within the program's design that encourage students to apply mathematical operations involving number sense and numeration, measurement, statistics and probability, and patterns and relationships.

## ABOUT THE PROGRAM FORMAT

- **NASAGuest:** features a NASAengineer, scientist, or technician to illustrate the application of classroom lessons to the workplace
- **Activities:** involves the use of hands-on activities drawn from NASA educational products, including the NCTM math activity books, *Mission Mathematics*, developed in collaboration with NASA
- **Students:** highlights elementary and middle school students and classrooms that have conducted the program's experiment and shared the results with viewers
- **Challenge Point:** includes pause period whereby students are presented with data and, working in pairs or small groups, are encouraged to perform analysis and data interpretation
- **Call, E-mail:** includes opportunity for students to call, or e-mail **before** the program and following the Challenge Point portion of the program with questions related to the program topic, the activity, or the guest
- **Print Materials:** provides registered educators with background on the program content, the guest, and the featured activity. Materials include a master copy of Challenge Point worksheets for copying and distribution to students and a listing of additional resources related to the program topic
- **Web Site:** enables viewers to register for the program, to download print materials, to submit evaluation, and to acquire additional information

NASA Langley researchers use satellites to study atmospheric variables and their effects. A few of the research topics are listed.

#### Clouds and the Earth's Radiant Energy System (CERES)



#### Earth Radiation Budget Experiment (ERBE)



#### Measurement of Air Pollution from Satellites (MAPS)



#### Stratospheric Aerosol and Gas Experiment III (SAGE)



For information on these and other Earth studies being conducted by Langley researchers, visit the Langley Atmospheric Sciences Division homepage at:  
<http://ascd-www.larc.nasa.gov>

## INTRODUCTION TO EARTH FROM SPACE

NASA's integrated research efforts to study Earth and its changing environment are a perfect centerpiece for interdisciplinary units involving the sciences, geography, international cooperation among governments, commerce and business, communication, and mathematics.

Some of the important ideas that educators and students might explore through NASA's Earth Science Enterprise include natural climate changes, such as volcanic eruptions, hurricanes, earthquakes, and El Niño. Another important environmental change is global warming and how it is related to the results of human activities, such as exhaust fumes from cars, deforestation, biomass burning, and chlorofluorocarbons (CFCs) in refrigeration, air conditioners, and industrial solvents and cleaners. Much of the data collected by NASA about our Earth and its atmosphere has been obtained with unmanned small satellite missions, high-altitude probes, and reentry experiments.

In this CONNECT program, students will explore how scientists have used satellites to study the impact of human activities on the global climate and will examine the mathematics behind the collected data from space-based instruments to study Earth's environment. Students will observe featured student "researchers" from the Portsmouth Public Schools (Portsmouth, VA) conducting an experiment to investigate the differences in distances traveled by rubber-band rockets when the launch angle and the amount of force vary. By working in pairs or small groups during the Challenge Point portion of the program, viewers will better understand how research teams must work together to conduct investigations.

## LEARN ABOUT NASA'S CONTRIBUTION TO EARTH SCIENCE

We understand some facets of our environment fairly well – short-term weather forecasts, basic hurricane tracking, and detecting changes on the Earth's surface. But we are missing a lot of other critical information, like the kind of data we need to predict how the climate will shift a year from now, and what the effects will be on people whose livelihoods depends on that climate – such as farmers, water managers, fishermen, and urban planners.

NASA has developed a program – Earth Science Enterprise – that captures our spirit of exploration and focuses it on the Earth. NASA and its interagency and international partners are striving to discover patterns in climate that will allow us to predict and respond to environmental events such as floods, droughts, and other weather-related hazards. Nations, regions, and individuals can then use this knowledge to prepare for these events, likely saving countless lives and resources.

The Earth Science research plan targets five issues for focused investment of resources during the next five years:

- Land-Cover and Land-Use Change Research
- Seasonal-to-Interannual Climate Variability and Prediction
- Natural Hazards Research and Applications
- Long-Term Climate: Natural Variability and Change Research
- Atmospheric Ozone Research

Additional information on NASA's Earth Science program and research issues and on its Education Strategic Plan can be found on its homepage at: <http://www.hq.nasa.gov/office/mtpe>

At the elementary and secondary levels, NASA seeks to enhance the knowledge, skills, and experience of teachers and to capture student interest in science, mathematics, and technology through the demonstration of integrated applications of related subject matter.

NASA's science, mathematics, and technology education programs and activities leverage its inspiring mission, unique facilities, and specialized workforce.

## MEET THE STUDENT HOST

### ***VAN M. HUGHES***

Van M. Hughes is a 14 year old freshman at Oscar Smith High School in Chesapeake, Virginia, where he maintains an Aaverage. He also attends the Governor's School for the Arts and is a very promising actor. In addition to the CONNECT Series, Van starred in the 1996 NASA instructional video, *Think BIGG*. On weekends Van plays guitar and is the lead singer in his own young country teenage band, "The Noodles."

## MEET THE PROGRAM HOST

### ***M. D. "SHELLEY" CANRIGHT, Ph.D.***

Dr. M.D. "Shelley" Canright serves as Precollege Officer in the Office of Education at NASALangley Research Center, Hampton, Virginia. She is responsible for planning and implementing the Center's precollege educational programs and for the development of new products that integrate NASA's four enterprises with the national education goals and standards. Dr. Canright has 18 years of professional work experience in the field of education, spanning local (classroom and school board) to federal-level positions and experiences. Shelley has developed and managed a number of educational programs and projects that have received national recognition and awards, including a U.S. Presidential Letter of Commendation. Her doctorate in Instructional Systems, with a research interest in instructional television, makes her contributions to the ongoing development of the CONNECT Series invaluable.

## MEET THE NASA GUEST

### ***MARY ANN H. SMITH, Ph.D.***

Dr. Mary Ann H. Smith is a senior research scientist in the Chemistry and Dynamics Branch of the Atmospheric Sciences Division at NASA Langley Research Center in Hampton, Virginia. She leads a small research group that makes laboratory measurements of the spectroscopic properties of atmospheric gases such as ozone, methane, and carbon dioxide. She also collaborates in the analysis of atmospheric remote sensing data from satellite-, balloon-, aircraft-, and ground-based experiments. Dr. Smith has over 20 years of research experience in the study of the atmospheres of the Earth and other planets, having earned a bachelor's degree in meteorology and a doctorate in geophysical sciences. She has contributed to more than 80 scientific papers and publications, is a member of several professional societies and advisory boards, and has received awards from NASA and other organizations. Dr. Smith has been active in NASA education and outreach activities for many years, including the 1997 CONNECT Video Series program, "The Heat is On".



## Section 2

### Preprogram Preparation Activities (Pgs. 5–9)

### Home Connection

- pgs. A10-A13
- Happens the week prior to the program



### Earth's Changing Atmosphere Poster

- Interpret graphs
- What a gas!
- Welcome to the "O" zone!
- Going Up!

### SKYMAX-13 Connects

- Primer for students on concepts of range and mean
- Links parents to lesson

### Preparing for the Challenge Point

- Make copies of appropriate worksheet (Pgs. 7–9).
- Divide students into small groups or pairs.

The information contained in this section is designed to prepare teachers and students to view the (video) program. There are four preprogram, or preparation, activities: (1) Read aloud to the students the brief summary of "Meet The NASA Guest," (2) display the poster that accompanies this guide and complete suggested activities, (3) **assign students to watch with a parent or guardian either the 5 p.m. or 6 p.m. weather report on WVEC, Channel 13 and complete one or both of the exercises found in Section 5: Home Connection**, and (4) divide students into pairs or small groups in preparation for the Challenge Point period.

### Preparing for the Program

1. **Earth's Changing Atmosphere poster .**
  - a) Display poster and lead a discussion with students on their interpretation of each graph—solar cycles, ozone averages, and global ozone.
  - b) Complete the following activities on backside of poster:  
K–4: What a Gas!  
5–8: Welcome to the "O" zone!
  - c) Make a transparency of the graph "Going Up!" Discuss where satellites are found. Older students might convert the scale from kilometers to miles. If appropriate, label the different layers of the atmosphere and discuss characteristics.
2. **SKYMAX-13 Connects.**
  - a) Make copies of the Parent Message and SKYMAX-13 Weather sheet exercises found in *Section 5: Home Connection*. Send home with students the homework assignment that for one school week—Monday through Friday—students are to watch with a parent the local evening weather report. This "home team" is to fill in the worksheet with specific weather information. At the end of the week, the team computes the range (Grades K–8) and mean (Grades 5–8) according to the directions on the worksheet. Ask students to bring completed worksheets to school to share and discuss results.
  - b) The forecast for the next day's morning and afternoon temperatures are given every evening except Sunday. Have students record this forecast. Select two hours – morning (e.g. 9am) and afternoon (e.g. 1pm) – and record the actual temperatures at school. Have students calculate the temperature difference between the forecast and actual (plus or minus).

### Preparing for the Challenge Point Period

Prepare for the program's Challenge Point period prior to the start of the program:

1. Make copies of the appropriate Challenge Point Worksheet and distribute one copy per student.
2. Divide students into small groups or pairs. Depending on the students, teachers may wish to do the Challenge Point as a large group.
3. Provide a calculator per group (optional) for grades 5–8.

**Program Materials**

- Challenge Point Worksheet
- Pencils
- Calculators (optional)

**Program Vocabulary**

- climate - *the average of local temperature, precipitation, wind conditions, and so forth over a period of years*
- orbit - *the path described by a heavenly body in its periodic revolution. Earth satellite orbits with inclinations near 0° are called equatorial orbits. Orbits with inclinations near 90° are called polar orbits.*
- satellite - *a free-flying object that orbits the Earth, another planet, or the sun*
- weather - *atmospheric condition at any given time or place*

**BEFORE THE PROGRAM**

The following suggestions will prepare the students for the program and help focus their attention on specific elements within the program's content.

**VOCABULARY**

1. Introduce the four vocabulary terms: climate, orbit, satellite, weather.
2. Challenge students to consider the relationship between climate and weather. List factors that influence weather and factors that influence climate.
3. Ask students to name satellites familiar to them.

**PREREQUISITE MEASUREMENT AND STATISTICAL CONCEPTS**

Students should be able to

- Find the range (Grades K-4)
- Find the range and mean (Grades 5-8)
- Use a protractor (Grades 5-8)

**DISCUSSION QUESTIONS**

List the following questions on the board. Have students discuss each question. Questions very similar to these will be asked of the featured guest. Following the program, go back to the questions and re-discuss.

1. Why study the atmosphere?
2. How can we tell if humans are altering the climate?
3. How do scientists measure the Earth's climate and weather?
4. What research are you involved in? How is mathematics used in your research?

Consider listing the questions that other students ask during the program's call-in period. Have students re-examine those questions after the show as a review of what was presented. This review would be a great check for student understanding and a good lead into conducting the lesson activity, "Protractor Rocket Launches" (see Section 4).

**CALL-IN/ E-MAIL OPPORTUNITY**

Divide the class into small groups and have each group come up with a list of questions they have about the program topic. Have groups share their group questions.

1. List each group's questions on the board and then select 2 to 3 questions from the list as a class.
2. E-mail these questions to CONNECT at [connect@edu.larc.nasa.gov](mailto:connect@edu.larc.nasa.gov)

**OR**

3. Call in with a question during the CONNECT call-in period:  
Toll Free 1 (888) 835-0026      Local 864-3991

# CHALLENGE POINT WORKSHEET

## PRIMARY LEVEL (GRADES K-4)

## Douglass Park Elementary School Students' Data

Sample Flight Distances (in centimeters)

Force: 7-cm stretch

Launch Number	30°	60°	90°
Launch 1	365 cm	247 cm	14 cm
Launch 2	385 cm	274 cm	16 cm
Launch 3	349 cm	294 cm	9 cm
Launch Range	_____ - _____ = _____	_____ - _____ = _____	_____ - _____ = _____

1. Review the data in the table. Circle the correct response to each question below:

a. Which angle produced the **longest** flight?  $30^\circ$   $60^\circ$   $90^\circ$

b. Which angle do you think produced the **highest** flight?      30°      60°      90°

Why do you think that?

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2. Order the launch data for each launch angle below from LEAST to GREATEST value. Subtract the greatest and least values to find the **range** for a launch angle. Record in data table.

30° |-----|  
60° |-----|  
90° |-----|

3. What is the relationship between the launch angle and the flight distance?

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**CHALLENGE POINT WORKSHEET  
INTERMEDIATE LEVEL (GRADES 5-8)**

Hunt-Mapp Middle School Students' Data  
Sample Flight Distances (in centimeters)

**Force: 7-cm stretch**

Launch Number	30°	60°	90°
Launch 1	331 cm	240 cm	18 cm
Launch 2	290 cm	220 cm	11 cm
Launch 3	313 cm	280 cm	16 cm
Launch 4	290 cm	243 cm	10 cm

**Force: 10-cm stretch**

Launch Number	30°	60°	90°
Launch 1	780 cm	623 cm	25 cm
Launch 2	750 cm	573 cm	12 cm
Launch 3	805 cm	600 cm	30 cm
Launch 4	835 cm	636 cm	24 cm

1. Examine the data displayed in both tables. What conclusions might you draw?

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**CHALLENGE POINT WORKSHEET  
INTERMEDIATE LEVEL (GRADES 5-8)  
CONTINUED**

Force 7-cm			Force 10-cm		
30°	60°	90°	30°	60°	90°
Range			55 cm	63 cm	18 cm
Mean			792.5 cm	608 cm	22.75 cm

2. Find the **range** of the data and the **mean** distance of the three launch angles at 7-cm force.

3. Predict how

a) increasing the stretch, or **force**, on the rubber band at the three launch angles would affect the resulting distance.

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b) varying the launch **angles** (e.g., 15°, 45°, and 75°) at the same amounts of force would affect the resulting distance.

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4. What comparison in distance traveled might be made between rockets launched at angles between 0°–90° and 90°–180°?

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## Section 3

### Viewing the Program (Pgs. 10–20)

#### Viewing the Program

The *Earth from Space* CONNECT program introduces students to the field of Earth Science by using a dialog between the program host and a NASA researcher. The program highlights students conducting an experiment that explores variables in rocket launches. The experiment focuses on the relationship between the amount of thrust and the angle of launch. Data generated from the students' experiment will be displayed to the viewers, and viewers will be challenged to interpret and analyze the data during the program's Challenge Point Period.

### Interactive Challenge Point

#### Challenge Point Period

This interactive program requires that each student record data on worksheets that are used during the program. Student worksheets and teacher answer keys are provided in this packet. Please note that there are worksheets and answer keys for Grades K-4 and Grades 5-8. Each CONNECT program is broadcast to two different audiences at two different times with modifications made to the experiment and presentation, as appropriate for the two audiences.

### Grades K–4 Challenge Point

The **K-4** program and its associated Challenge Point will emphasize experimentation with one variable, the angle. Students will examine the relationship of the thrust and the angle of launch of an object to the distance traveled. The constant in the experiment will be the force (thrust) applied to the object. The changing (independent) variable will be the launch angle. Students will work with trial data to find the **range** for each launch angle. Number sense and numeration, measurement, and patterns and relationships will be emphasized.

### Grades 5-8 Challenge Point

The **5-8** program and the Challenge Point will emphasize two variables, thrust and angle, and the relationships of these variables to distance traveled. Students will examine three launch angles and the effect the angle and an increase in force has on the distance a rocket travels. Students will compute the **range** and **mean** for the data. Number sense and numeration, measurement, statistics and probability, and patterns and relationships will be emphasized.

### Further Exploration

Further extensions to the program and additional Earth Science resources are outlined on pages 15–20.

### Evaluation Form

<http://edu.larc.nasa.gov/connect/evaluation.html>

What did you think of CONNECT 3: *Earth for Space*? Please complete the enclosed postage-paid evaluation card. Or, to send us your comments electronically, go to <http://edu.larc.nasa.gov/connect/evaluation.html>

**NCTM Standards**

- Number Sense and Numeration
- Measurement
- Statistics
- Patterns and Relationships

**Program Objectives**

- Conduct experiment: collect, organize, display, and interpret data; make predictions
- Find the range and mean
- Work cooperatively in pairs/teams

**Challenge Point Tip**

- Arrange students in pairs or small groups before the program begins
- Distribute copy of Challenge Point worksheet to each student
- Distribute one calculator per group (optional)

**Challenge Point****Assessment Tip**

- Observe which students can find the range and mean and which students need to learn how
- Talking and writing about predictions and interpretation of data help students confirm their learning

**Technology Tip**

Providing calculators for students to use may facilitate reasoning for students who have not mastered multiplication or division.

**THE PROGRAM CHALLENGE POINT**

Built within the program's design is a pause period (approximately 4 minutes long) in which students will be asked to look at generated data and, working in pairs or small groups, respond to questions, one at a time, as listed on the Challenge Point Worksheet (see p. 7 [Grades K-4] & p. 8-9 [5-8]). This pause period is important for providing students the opportunity to work with information presented up to this point and to actively examine and work with data in support of the NCTM standards.

**DURING THE CHALLENGE POINT PERIOD***Teacher as Facilitator*

Built within the program's design is a pause period in which students will be asked to look at data and, working in pairs or small groups, respond to questions and complete tables or graphs detailed on the Challenge Point Worksheet.

1. Make copies of the Challenge Point Worksheet and distribute one copy per student before starting the program.
2. Depending on the students, teachers may wish to have a large group or divide students into pairs or smaller groups. This grouping should be done in advance of the program.
3. The teacher is to act as a facilitator during this program time, supporting and guiding the students in discussion and in responding to the worksheet questions.

*Student as Researcher*

By working in pairs or small groups, students will better understand how NASA research teams must work together to analyze and interpret findings and to communicate results in written, oral, and graph forms.

1. Observe the data shown on the television, as recorded by the featured school and as displayed on the worksheet.
2. Questions pertaining to the data will be presented one at a time on the videotape. You will have a limited amount of time to discuss the question with your partner(s), calculate an answer, if necessary, and write down a response.
3. Feedback to the questions will be presented to you at the end of the Challenge Point period. Review your answers. Following the program, continue your discussions if necessary.



# CHALLENGE POINT WORKSHEET

## PRIMARY LEVEL (GRADES K-4)

### ANSWER KEY

Douglass Park Elementary School Students' Data

Sample Flight Distances (in centimeters)

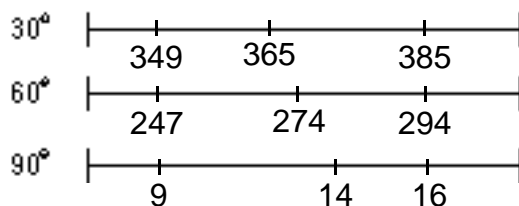
Force: 7-cm stretch

Launch Number	30°	60°	90°
Launch 1	365 cm	247 cm	14 cm
Launch 2	385 cm	274 cm	16 cm
Launch 3	349 cm	294 cm	9 cm
Launch Range	$\frac{385 - 349}{36 \text{ cm}} =$	$\frac{294 - 247}{47 \text{ cm}} =$	$\frac{16 - 9}{7 \text{ cm}} =$

1. Review the data in the table. Circle the correct response to each question below:

a. Which angle produced the **longest** flight?☒ 30°    60°    90°b. Which angle do you think produced the **highest** flight?30°    60°    ☒ 90°

Why do you think that?

2. Order the launch data for each launch angle below from LEAST to GREATEST value.  
Subtract the greatest and least values to find the **range** for a launch angle. Record in data table.

3. What is the relationship between the launch angle and the flight distance?

As the launch angle increased, the flight distance decreased.



**CHALLENGE POINT WORKSHEET**  
**INTERMEDIATE LEVEL (GRADES 5-8)**  
**ANSWER KEY**

Hunt-Mapp Middle School Students' Data  
Sample Flight Distances (in centimeters)

**Force: 7-cm stretch**

Launch Number	30°	60°	90°
Launch 1	331 cm	240 cm	18 cm
Launch 2	290 cm	220 cm	11 cm
Launch 3	313 cm	280 cm	16 cm
Launch 4	290 cm	243 cm	10 cm

**Force: 10-cm stretch**

Launch Number	30°	60°	90°
Launch 1	780 cm	623 cm	25 cm
Launch 2	750 cm	573 cm	12 cm
Launch 3	805 cm	600 cm	30 cm
Launch 4	835 cm	636 cm	24 cm

1. Examine the data displayed in both tables. What conclusions might you draw?

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*Answers will vary.*

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**CHALLENGE POINT WORKSHEET**  
**INTERMEDIATE LEVEL (GRADES 5-8)**  
**ANSWER KEY CONTINUED**

Force 7-cm				Force 10-cm			
	30°	60°	90°		30°	60°	90°
Range	41 cm	60 cm	8 cm		55 cm	63 cm	18 cm
Mean	306 cm	245.75 cm	13.75 cm		792.5 cm	608 cm	22.75 cm

2. Find the **range** of the data and the **mean** distance of the three launch angles at 7-cm force.

3. Predict how

a) increasing the stretch, or **force**, on the rubber band at the three launch angles would affect the resulting distance.

\_\_\_\_\_

*Answers will vary.*

\_\_\_\_\_

b) varying the launch **angles** (e.g., 15°, 45°, and 75°) at the same amounts of force would affect the resulting distance.

\_\_\_\_\_

*Answers will vary.*

\_\_\_\_\_

4. What comparison in distance traveled might be made between rockets launched at angles between 0°–90° and 90°–180°?

\_\_\_\_\_

*Answers will vary.*

\_\_\_\_\_

NASA's Education Program is guided by its **Strategic Plan for Education** and is carried out through its nine field centers and the Jet Propulsion Laboratory.

Education programs are grouped into six general categories:

- Teacher/Faculty Preparation and Enhancement Programs
- Curriculum Support & Dissemination Programs
- Support for Systemic Change
- Student Support Programs
- Educational Technology Programs
- Mission, Research & Development, and Operations Programs

**NASA Education Link:**

<http://www.hq.nasa.gov/education>

**NASA Langley Office of Education Web Site:**

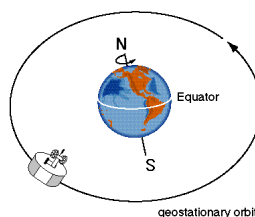
<http://edu.larc.nasa.gov/>

## FURTHER EXPLORATION

1. Complete the Protractor Rocket Launches activity contained in the appendix. This activity has been taken from the *K-6 Mission Mathematics: Linking Aerospace with the NCTM Standards*. The Mission Mathematics product is available through the National Council of Teachers of Mathematics (NCTM). See item 9 for more information.

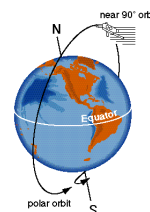
*NCTM Assessment Standard for Protractor Rocket Launches:* Each team can report its findings and conclusions orally to the class. Reporting gives students an opportunity to plan and rehearse a group presentation. Allow students to enhance their understanding of using graphs as a tool for communicating by reporting their findings. Make the assessment an open process by having students help create a checklist as they prepare and rehearse their presentation.

2. **Geostationary and Polar Satellites.** Present the following information and situations to students. Have them determine the appropriate satellite system — geostationary or polar — for the given situations.



**Geostationary Orbit**

Geostationary satellites orbit Earth at a speed and altitude so they continuously hover over one point on Earth, providing constant coverage of a specific area.



**Polar Orbit**

Polar-orbiting satellites orbit Earth in a path that crosses almost directly over the poles to provide real-time information about Earth and its atmosphere.

Select a satellite system appropriate for gathering data for the following scenarios. Use a globe and rubber band to help find the answers to the following situations. *Hint: Stretch a rubber band around the globe, intersecting the specific regions.*

- a) Scientists want current data on the global effects of deforestation in South America. What type of satellite is most appropriate for this study? Find an appropriate orbit.
- b) Scientists are interested in studying ozone levels in the Arctic and Antarctic. What type of satellite is most appropriate for this study? What would the orbit be?
- c) Students are comparing the current climatology to conditions ten years ago in their neighborhood near Lake Erie. From what type of satellite would they want data? What would the orbit be?

### 3. Modeling Activity (Grades K-4).

**Satellite Construction.** Students can make their own satellites out of paper, cardboard, and recycled containers. Use foil or plastic wrap on a cardboard frame for solar array; paper or foil plates could be antenna dishes; aluminum foil could be a heat-resistant metallic surface.

Encourage the students to pretend that their satellites are going to observe components of the Earth system. Let them use their imaginations to determine the satellite's shape, instruments, and the equipment it will need according to what they are going to observe. When they are finished, hang the satellites from the ceiling with fishing line.

### 4. Mission to Planet Earth (Grades 5-8 Teams).

Your mission is to investigate the effect of human activity on the Earth's ecosystem and develop a Mission Plan that addresses one of our planet's environmental dilemmas.

#### **Rules**

- The design team must consist of 3 or 4 students.
- Each entry must be the students' original work. Copyrighted materials must be properly cited.
- The project should be formatted with sections subtitled as follows:
  - a. Title Page
  - b. Abstract – A concise statement, 100 words or less, describing the overall proposal.
  - c. Mission Plan – In your Mission Plan, include and label the following:
    - 1) Analysis of Problem – Which human activities are most likely to cause global change? Given limited funds, which factors affecting the Earth's ecosystem should be studied first?
    - 2) Experimental Design – What problem(s) or factor(s) affecting the Earth's ecosystem will be investigated? What is the hypothesis? What data are needed? How will it be collected? For space-based observations, consider the following: the number of satellites; type of instruments; type of orbit; and length of time in orbit.
    - 3) Plan for the Future – How can we reduce the impact of human activity? How do we get the population to agree to the changes? How do we avoid economic and social problems?
  - d. Bibliography – Cite all sources used in developing your project, including web sites.
- All diagrams, charts, and pictures must be labeled with source origin, for example, "student's original work" or "taken from www.anysite.com."
- The Mission Plan (Analysis, Experimental Design, and Plan for the Future) may not contain more than 1,500 words total.

**Judging Criteria** (Total of 50 points)

- 15 Scientific validity and critical thinking
- 10 Creativity and originality of Mission Plan
- 10 Organization, clarity, and appropriate references
- 10 Suitability of the Mission Plan
- 5 Grammar, syntax, and spelling

**5. Relating Science to...**

**Geometry:** You may not realize it, but if you have ever cut out paper snowflakes you were illustrating a scientific fact. To discover what that fact is, divide into teams and make snowflake patterns. Each team will need a compass, several pieces of white paper, a protractor, a pencil, and a pair of scissors.

- a. Using a compass, draw a circle about 15 cm in diameter.
- b. Cut out the circle.
- c. Fold the circle in half.
- d. Place the half-circle on the table with the fold toward you.
- e. Measure the folded edge to find the middle point.
- f. Place the center of a protractor on this middle point.
- g. Measuring up from the left corner, place a dot at the 60° point at the outer edge of the half-circle.
- h. Fold the bottom corner on the left up and across to the right, forming a cone. Keep the right edges of the cone even.
- i. Using your scissors, cut straight across the open end of the cone from corner to corner so all the edges will be straight and a triangle will be formed.
- j. Cut decorative notches in the three sides and the middle of the triangle. Be creative!
- k. Repeat this procedure with two more pieces of paper.
- l. Cut each triangle a little differently. Cut only the outside edges of the last triangle you make.
- m. Now unfold each snowflake you have made.
- n. Answer the following questions:

1. Each team should display its work. What do all the snowflakes have in common? (*Answer: They all have six sides*)
2. Ice crystals always assume the same shape. What is that shape called? The last shape, the plainest, is the basic shape of an ice crystal. The fancier shapes grow if there is a large amount of water vapor in the air and temperatures are low. (*Answer: Hexagon*)

**History:** Scientists have been investigating the mysteries of the atmosphere for thousands of years. Read an encyclopedia article on the atmosphere or look at Isaac Asimov's book, *How Did We Find Out About the Atmosphere?* Make a timeline, marking the years when important discoveries were made. What were some discoveries made from space?

**Math:** Calculate weekly, monthly, and yearly averages of temperature and rainfall in your area. Make a bar chart showing average temperatures for each time span. Another important statistic is how

much temperature and rainfall changes differ from the average. This difference is called the “standard deviation” because it measures how much something “deviates” or differs from the average.

**Mythology:** In the library, have students read about and report their findings on the following characters associated with the wind in Greek mythology: Aeolus, Zephyrus, Notus, Eurus, and Boreas.

**Weather:** Have students keep a daily log in which they measure and record the temperature and observe percent cloud cover the same time each day. Continue this for one month and then graph the results. Do the students see any trends or relationships?

**Writing:** John Muir, an American Naturalist, once said:  
 “When we try to pick out anything by itself, we find it  
 hitched to everything else in the universe.”

Using Muir’s statement as a writing prompt, have students explain its meaning and how it can be applied to the goal of NASA’s Earth Science program.

6. Explore the following web sites for online projects and activities that connect with the study of Earth and environmental science:

*S’COOL* <http://asd-www.larc.nasa.gov/SCOOOL>

*Seeking classrooms (3-12) to provide ground-based measurements in support of a NASA Langley-developed satellite experiment (CERES) that was launched in Nov. 1997. Students work in teams and form a consensus of their observations – types of clouds, clouds’ altitudes, and amount of cloud coverage – then report via the Internet where their data are stored for further analysis by researchers. Researchers will use student data to compare to the CERES satellite data.*

*Global Observations to Benefit the Environment (GLOBE)* <http://www.globe.gov>

*Worldwide network of (K-12) students, teachers, and scientists working together to study and understand the global environment. Students make a core set of environmental observations at or near their school and report their data via the Internet.*

*Exploring the Environment* <http://www.cotf.edu/ETE>

*Explore, investigate, question, and communicate. This online project engages middle and high school students in collaborative scientific inquiry and analysis through problem-based environmental Earth science modules that use remote sensing technology and the Internet. There are over 14 modules to select from. Modules include topics such as Weather or Not?; Severe Weather: Hurricanes!; El Niño: The Child Returns; UV Menace; and Earth on Fire.*

*Why Files: Science Behind the News* <http://whyfiles.news.wisc.edu/>

## 7. On-Line Resources for Students and Educators

Visit the *NASA Home Page* and the *Earth Science Home Page*:

**NASA Home Page** <http://www.nasa.gov>

**NASA Earth Science** <http://www.hq.nasa.gov/office/mtpe>

Check out some of the following *Earth Science Web Resources*:

*NASA Education Links:*

**Education Home Page** <http://www.hq.nasa.gov/education>

**EarthKAM** <http://www.kidsat.ucsd.edu>

**Current State of the Tropical Pacific (El Niño) web site** <http://nsipp.gsfc.nasa.gov/enso>

**El Niño** [http://observe.ivv.nasa.gov/nasa/earth/el\\_nino/el\\_nino.html](http://observe.ivv.nasa.gov/nasa/earth/el_nino/el_nino.html)

**Learning Technologies Project** <http://learn.ivv.nasa.gov>

**Observatorium** <http://observe.ivv.nasa.gov>

**Spacelink** <http://spacelink.nasa.gov>

### **Mission to Planet Earth (MTPE) Fact Sheet**

<http://www.hq.nasa.gov/office/pao/facts/HTML/FS-008-HQ.html>

### **MTPE Education Programs and Resource Catalog**

<http://spacelink.msfc.nasa.gov/Educational.Services/>

[Mission.to.Planet.Earth](http://Mission.to.Planet.Earth)

**WeatherNet4** <http://wxnet4.nbc4.com>

## 8. NASA Educational Resources. The Mission to Planet Earth materials below are available from NASA Educator Resource Centers (ERC).

Below are sample educational products available by contacting the NASA ERC that services your region/state.

- Teacher Guides**
- Atlas 1 Earth's Mysterious Atmosphere Teacher's Guide (grades 5-8; EP-282 11/91)
  - Atlas 2 Teacher's Guide with Activities: Atmospheric Detectives (grades 5-8; EP-285 11/92)
  - Our Mission to Planet Earth: A Guide to Teaching Earth System Science (EP-292 6/94)

- Videos**
- Liftoff to Learning: The Atmosphere Below (length 16:00) and Video Resource Guide (VRG-006-1292)
  - Beyond the Clouds: The Upper Atmosphere (length 12:10) and Video Resource Guide (VRG-002 8/91)

**Slide Sets** • Atlas 1: Studying Mysteries in the Earth's Atmosphere

**Fact Sheets** Mission to Planet Earth series:

- "Ozone: What is it and why do we care about it?"
- "Clouds and the Energy Cycle"
- "El Niño"
- "Global Warming"
- "Volcanoes"
- "Biosphere"
- "Polar Ice"

NASA Facts are documents that provide general information and background on NASA-related missions, research topics, and activities.

Information on the locations, addresses, and telephone numbers of the NASAERCs can be found online at

<http://www.teacherlink.usu.edu/nasa/accessnasa/TRC.html>

Educators within Langley's 5-state service region of KY, NC, SC, VA, and WV should write to

Virginia Air & Space Center  
NASA Langley Educator Resource Center  
600 Settlers Landing Road  
Hampton, VA 23669-4033  
(757) 727-0900, ext. 757

9. Leap into more Earth Science-related mathematics activities from the National Council of Teachers of Mathematics (NCTM) and the new NASA-funded product, *Mission Mathematics: Linking Aerospace with the NCTM Standards*.

**Mission Mathematics:**

- integrates mathematics and science following the guidelines of the NCTM standards
- motivates students to explore math and develop mathematical thinking
- features activity books and posters for Grades K-6, 5-8, and 9-12

Contact the NCTM, 703/620-9840, for more information, or visit their web site, at <http://www.nctm.org/>

## Section 4

### Protractor Rocket Launches

### Classroom Experiment

### Self-Contained Lesson

The following lesson plan will allow your students to duplicate the experiment that was shown during *Earth from Space*, Program 3 of the CONNECT Series. Copies of the video can be made at the NASA Langley Educator Resource Center.

Nick Kolten, ERC Manager  
Virginia Air & Space Center  
NASA LaRC ERC  
600 Settlers Landing Road  
Hampton, VA 23669-4033  
(757) 727-0900, ext. 757  
<http://www.vasc.org/erc/>



## INTRODUCTION

Much of the data collected by NASA about our Earth and its atmosphere has been obtained with unmanned small satellite missions, high-altitude probes, and reentry experiments. Each year, NASA launches an average of thirty sounding rockets. The name derives from the nautical term to sound or to take measurements. Fourteen different sounding rockets come in sizes that range from 7 feet to 65 feet.

Sounding rockets fly for fewer than 30 minutes, can reach altitudes of more than 400 miles, and carry payloads of instruments for experiments. The payload reenters the atmosphere, falls to Earth with a deployed parachute, and is recovered. These inexpensive rockets allow scientists to conduct investigations about the upper atmosphere, the Sun, stars, galaxies, and other planets.

Over the years, NASA has used eight major space vehicles that range in size from the 75-foot Scout to the 363-foot Saturn V rocket to perform suborbital tasks as well as to launch interplanetary exploration. Unmanned Scout launch vehicles have been successfully used to place payloads into orbits at much less expense than Shuttle missions. The Saturn V is better known. It was used for the Apollo missions and for placing the Skylab Space Station into Earth orbit. Since 1981, the most familiar rockets are those used for the Space Shuttle.

Invite your students to explore variables involved with rocket launches—the amount of thrust and the angle of launch. They can pretend to be NASA scientists who conduct experiments; collect, analyze, and interpret data; and reach conclusions.

## PURPOSES

- **Grades K-8:**
  - To measure distances
  - To collect, organize, analyze, and interpret data
  - To find the range
- **Grades 5-8:**
  - To measure angles with a protractor
  - To find the median and mean of a set of data
  - To use estimation to determine the reasonableness of sums found with a calculator

## NCTM STANDARDS

- Measurement
- Statistics
- Patterns and Relationships
- Number Sense and Numeration

## NCTM ASSESSMENT STANDARDS

- Talk and write about predictions and interpretations of data to help students confirm their learning
- Observe which students can find the range and mean and which students need to learn

## INSTRUCTIONAL OBJECTIVES

- **Grades K-8:**
  - Conduct experiment: collect, organize, display, and interpret data
  - Find the range
  - Work cooperatively in pairs/teams
- **Grades 5-8:**
  - Find the mean
  - Measure angles

## PREREQUISITE MEASUREMENT AND GEOMETRY CONCEPTS

Students should be able to

- **Grades K-8:**
  - Conduct experiment: collect, organize, display, and interpret data
  - Work cooperatively in groups
  - Understand the concepts angle and range
- **Grades 5-8:**
  - Use a protractor
  - Understand the concepts median and mean

## EXPERIMENT MATERIALS

Protractors, rulers, tape, small rubber bands of the same size (preferably 3cm in diameter), plastic straws, stapler, metersticks or centimeter tape measures, clay (optional)

## PRINT MATERIALS

- Challenge Point Worksheet
- Rubber-band Rocket Instructions

## MANAGEMENT TIP

You may want small groups of students to work together as launch teams. The teams could make the rubber-band rockets, prepare the launch pads, and assign roles for the experiment. K-4 teachers may want to assemble the launch pads for their students. Each team should experience at least two or three launches with each of the three launch angles.



## GETTING STARTED

Students explore differences in the distances traveled by rubber bands launched from various angles. The three angle measurements to be tested are 30-degrees, 60-degrees, and 90-degrees. The size of the rubber bands tested remains constant, such as a circumference of 10 cm and a diameter of 3 cm. In the first experiment, the amount of stretch in the rubber band also remains constant because each rubber band is pulled to the same 7-cm mark on the ruler of the launch pad. Students in grades 5-8 will conduct a second experiment in which the amount of stretch in the rubber band is pulled to the same 10-cm mark on the ruler of the launch pad.

If this is your students' first experience with protractors, you will want to take some time to introduce this new tool for measuring angles. Let the students explore how the ruler is tilted differently when they place it to form the 30°, 60°, and 90° angles.

## VOCABULARY TERMS

- **Climate:** The meteorological conditions, including temperature, precipitation, and wind, that characteristically prevail in a particular region
- **Orbit:** The path described by a heavenly body in its periodic revolution. Earth satellite orbits with inclinations near 0° are called equatorial orbits. Orbits with inclinations near 90° are called polar orbits.
- **Satellite:** A manmade object intended to orbit a celestial body
- **Weather:** The state of the atmosphere at a given time and place, described by specification of variables such as temperature, moisture, wind velocity, and barometric pressure

## CLASS DISCUSSION

1. What are some examples of human activity that cause changes to the atmosphere and environment?
2. What types of research tools are used by scientists to collect data on the environment?

## BEFORE THE ACTIVITY

**Safety Note:** Have students wear goggles during the launches. Do not allow students in the landing area while the launches are being conducted!

- Prepare the launch pads. First, securely tape a ruler to a protractor, centimeter side facing up, to form a 30° angle. In taping the rulers to the protractors, be sure not to let the ruler extend below the straightedge base of the protractor. The protractors are set upright on a flat surface for the rubber band launches and therefore need a level bottom surface. Next, tape a second ruler to the second protractor to form a 60° angle. Finally, tape the third ruler to the last protractor to form a 90° angle.
- Prepare the launch site by placing at least six metersticks end to end or by laying out six meters of measuring tape on the floor and six meters of measuring tape on the wall near the launch site (to measure the height of the launch at the 90° angle). To make a more stable launch pad, put some clay on each end of the protractors and anchor them to the floor or ground at the front edge of the first meterstick.
- Make copies of the Challenge Point Worksheet (A6-A8) and Rubber-band Rocket Instructions (A9) and distribute one to each student.
- It is important to use rubber bands of the same size.

## DEVELOPING THE ACTIVITY

Ask the students to predict the results of the launches.

### Class Discussion

- Which launch pad do you predict will produce the longest flights?
- Which launch pad will produce the highest flights?
- Which launch pad looks most like the one from which the Space Shuttle is launched, in terms of the launch angle?
- Where do you think the rubber bands launched at the 60° angle and the middle



angle will fall? Will their distances be exactly half way between the distances for the rubber bands launched at the 30° and 90° angles?

Divide the students into Launch Teams of 3 to 5 members. Distribute launch pads, rubber-band rockets, and metersticks or six meters of measuring tape to each team and give a copy of the Challenge Point Worksheet to each student. Instruct the students to work as a team and assign the following responsibilities: (1) launch the rubber-band rocket, (2) measure the distance of the launch, (3) retrieve the rubber-band rocket, and (4) record the data.

#### Grades K-4

Launch Teams should launch the rubber-band rockets by looping the rubber band over the free end of the ruler, pulling it back until it reaches the 7-cm mark. They should observe the direction and height of the launch and record their data on the Challenge Point Worksheet. The process is repeated for at least three launches at each angle, being careful to let go of the rubber bands at exactly the same place on the ruler each time. The members of the team then compute the range of each angle. (They can recognize easily the least and greatest values and then compute the difference of these two values to find the range of the data.) After the teams have completed this process, bring the class together to discuss their findings. Refer to K-4 Questions.

#### Grades 5-8:

Follow directions as outlined above. However, students in grades 5-8 will repeat the experiment by launching their rubber-band rockets a second time by pulling back until it reaches the 10-cm mark.

In addition to finding the range, 5-8 students will find the mean of the data.

Students should use calculators to calculate the mean distance for each of the three angles. Students should estimate the sum of the distances for each angle (in each column) before they add. One way to estimate is to choose a middle value in the line plot or stem-and-leaf plot and multiply the value by the number of

trials. This process will help them know whether the sum showing in the display of the calculator is reasonable.

After the teams have completed this process, the students write responses to the 5-8 questions using their data. Bring the class together to discuss their findings.

### CLASS DISCUSSION

#### Grades K-4 Questions

1. Complete the sentences:
  - a) The rockets launched at \_\_\_\_\_° (30, 60, or 90°) traveled the longest distance.
  - b) The rockets launched at \_\_\_\_\_° traveled the highest distance.
2. Order the launch data for each launch angle from LEAST to GREATEST value to find the range. (Hint: To find the range, compute the difference between the least and greatest values for a launch.) Compute and record the range in the data table.
3. What is the relationship between the launch angle and the flight distance?

#### Grades 5-8 Questions

1. Examine the data. What conclusions might you draw about this experiment?
2. Can you use just one number to tell how far the rubber-band rocket traveled at each angle?
3. Find the range of the data and the mean distance of the three launch angles.
4. Predict how (a) increasing the stretch, or force, on the rubber band at the three launch angles would affect the resulting distance (e.g., 15-cm, 18-cm); (b) varying the launch angles (e.g., 15°, 45°, and 75°) at the same amounts of force would affect the resulting distance.
5. What comparison in distance traveled might be made between rockets launched at angles between 0°-90° and 90°-180°?



## FURTHER EXPLORATION

- Conduct the investigation again, but this time increase the stretch, or force, on the rubber band. Make predictions about how this change in force will affect the resulting distances before gathering the new data. Collect data at several points: 12-cm stretch, 15-cm stretch, and so on. Does a pattern emerge? What is the effect of an increase in force on the distance traveled?
- Conduct the investigation again, this time varying the launch angles by using such angles as  $15^\circ$ ,  $45^\circ$ , and  $80^\circ$ . Collect data using the same size rubber bands and the same amounts of force, or stretch, as in the earlier investigations. How do these results compare with your original data? What patterns do you see? What is the relationship between the launch angle and the flight distance?
- **Grades K-4:** Vary launch angle further ( $100^\circ$ ,  $120^\circ$ ,  $165^\circ$ ), using the same force. How do the results compare to launch angles at  $15^\circ$ ,  $45^\circ$ , and  $80^\circ$ ?
- **Grades 5-8:** Use decimals to record flight distances. For example, 345 centimeters would be recorded as 3.45 meters.



## CHALLENGE POINT WORKSHEET PRIMARY LEVEL (GRADES K-4)

Elementary School Students' Data  
Sample Flight Distances (in centimeters)  
Force: 7-cm stretch

Launch Number	30°	60°	90°
Launch 1			
Launch 2			
Launch 3			
Launch Range	_____ - _____ = _____	_____ - _____ = _____	_____ - _____ = _____

1. Review the data in the table. Circle the correct response to each question below:

a. Which angle produced the **longest** flight? 30° 60° 90°

b. Which angle do you think produced the **highest** flight? 30° 60° 90°

Why do you think that?

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2. Order the launch data for each launch angle below from LEAST to GREATEST value.  
Subtract the greatest and least values to find the **range** for a launch angle. Record in data table.

30° | \_\_\_\_\_ |

60° | \_\_\_\_\_ |

90° | \_\_\_\_\_ |

3. What is the relationship between the launch angle and the flight distance?

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**CHALLENGE POINT WORKSHEET  
INTERMEDIATE LEVEL (GRADES 5-8)**

Middle School Students' Data  
Sample Flight Distances (in centimeters)

**Force: 7-cm stretch**

Launch Number	30°	60°	90°
Launch 1			
Launch 2			
Launch 3			
Launch 4			

**Force: 10-cm stretch**

Launch Number	30°	60°	90°
Launch 1			
Launch 2			
Launch 3			
Launch 4			

1. Examine the data displayed in both tables. What conclusions might you draw?

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**CHALLENGE POINT WORKSHEET**  
**INTERMEDIATE LEVEL (GRADES 5-8)**  
**CONTINUED**

Force 7-cm			Force 10-cm		
30°	60°	90°	30°	60°	90°
Range					
Mean					

2. Find the **range** of the data and the **mean** distance of the three launch angles at 7-cm force.

3. Predict how

a) increasing the stretch, or **force**, on the rubber band at the three launch angles would affect the resulting distance.

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b) varying the launch **angles** (e.g., 15°, 45°, and 75°) at the same amounts of force would affect the resulting distance.

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4. What comparison in distance traveled might be made between rockets launched at angles between 0°–90° and 90°–180°?

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**BS2000 RUBBER BAND ROCKET**

1. Cut a plastic straw in half



2. Loop a small rubber band onto one end of a paper clip



3. Slide the clip with rubber band into one end of straw and staple the end together



4. At the other end of the straw, make a 1-inch cut through both sides

5. Cut out two 1-inch by 1/2-inch rocket fins



7. Launch your rocket by looping the rubber band over the free end of the ruler, pulling it back until it reaches the desired mark, and letting go.

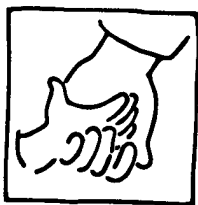


6. Place fins together and slide all the way up the cuts. Place a staple through the plastic and the fins. Pull apart fins and bend them so they are equally spaced around your rocket.

## Section 5

### Home Connection

#### Two Exercises



#### National Education Goal 8:

By the year 2000, every school will promote partnerships that will increase parental involvement in promoting the social, emotional, and academic growth of children.



As part of a unique partnership with WVEC Channel 13, we are introducing a new educational element to the third program in our CONNECT series. It is called Home Connection, and it encourages parents and children to work together in a 5-day investigation prior to the broadcast of CONNECT 3. The investigation is accomplished by watching either the 5:00 or 6:00 p.m. SKYMAX weather report on WVEC Channel 13. The SKYMAX meteorologists will provide the temperature data to be recorded on the enclosed SKYMAX Weather Sheet. WVEC Channel 13 will feature these data on their 5:00 and 6:00 p.m. weather reports for the weeks of February 2-6 and February 9-13. During the broadcasts, parents and their children will record the temperature readings on the SKYMAX Weather Sheet. Students in Grades K-4 will compute the range, and students in Grades 5-8 will compute the range and the mean.

The two Home Connection exercises are designed to give additional support to the math concepts presented in the CONNECT 3 program. Use of the exercises is optional. Educators are encouraged to modify the exercises to meet the particular needs of their students and as dictated by the curriculum. Educators registering for CONNECT 3 will receive "free" Channel 13 News stickers courtesy of WVEC-TV. They can be used to encourage students to participate in Home Connect.



For over 40 years WVEC-TV has had a strong tradition of community service. Community support is an investment in the future success of Hampton Roads (Virginia).

Since 1993 WVEC has presented *School Spirit*, a national award winning project, devoted to providing educational opportunities to teachers, students, and parents in Hampton Roads.

We are proud to partner with NASA in our continuing commitment because we know that the only thing more expensive than education is ignorance.

WVEC provides accurate, up-to-date information on school closings. Watch 13 SKYMAX meteorologist Craig Moeller from 5 to 7 a.m. on 13 News Daybreak on Channel 13.

## HOME CONNECTION

### Dear Parent or Guardian,

Our class has been studying the changes taking place in the atmosphere and how satellites are used to measure the interactions of Earth's land, oceans, and atmosphere. As a matter-of-fact, satellites are a daily part of everyone's life! For example, data from satellites are changed to measurements that are useful for studying and forecasting weather.

NASA and the National Oceanic and Atmospheric Administration (NOAA) supply local news programs with information for their weather reports. With this information, meteorologists are better able to provide the local community with accurate and timely weather reports.

To help your child make connections between mathematics and science, NASA Langley and WVEC have created a special opportunity. We invite you to participate with your child in a five-day "investigation" that can be accomplished by watching the 5 p.m. or 6 p.m. weather report on Channel 13.

## MATERIALS NEEDED



SKYMAX Weather Sheet  
Television tuned to WVEC Channel 13  
Pencil  
Calculator (optional)

## PROCEDURE



Watch the **5 p.m. or 6 p.m. WVEC-13 SKYMAX Weather** report during the week (Monday-Friday). Chief Meteorologist Jeff Lawson will provide student and parent viewers with temperature data to be recorded onto the SKYMAX Weather

Sheet. WVEC will feature this special addition to their weather report for two weeks, February 2-6 and February 9-13. Pick one of these weeks to complete the "assignment" with your child.

At the end of the five days, calculate with your child the **range**, if your child is in Grade K-4, and the **range** and **mean**, if your child is in Grade 5-8, for the collected data. This exercise will help prepare and reinforce the mathematics concepts that are featured in the NASA CONNECT video program: *Earth from Space*. Have your child return the completed SKYMAX Weather Sheet to the teacher for class discussion and follow-up.

## CONNECT

You are invited to participate in *CONNECT: Earth from Space*. This live, interactive television program will be broadcast on



WHRO Channel 15 on

February 10: 12:30 to 1:00 p.m., Grades 5-8

February 17: 12:00 to 12:30 p.m., Grades K-4

**SKYMAX Weather Sheet****HOME CONNECTION  
EXERCISE 1****Learner Objectives:**

- Number sense and numeration
- Statistics (range and mean)
- Patterns and relationships (rows and columns)
- Listening, reasoning, and comprehension

**Computations:**

- Calculate the range by subtracting the lowest temperature from the highest temperature.  
(Performed by students in Grades K-4 and 5-8.)
- Calculate the mean by adding the temperatures and determining the total.
- Next, divide the total by either the number of days or cities.  
(Performed by students in Grades 5-8 only.)

**Directions: Current Temperature**

1. Watch either the 5 p.m. or the 6 p.m. SKYMAX Weather report on WVEC Channel 13 for five days (Monday-Friday) during one of these weeks  
February 2-6    **OR**    February 9-13
2. Select one of the time slots (5 p.m./6 p.m.) to watch for the five days.
3. Record the current temperature as given by SKYMAX Weather Chief Meteorologist, Jeff Lawson.
4. Calculate both the range and the mean and enter the data.

**Current Temperature**

	M	T	W	Th	F	Range	Mean
Time Slot: _____	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

**Directions: Today's High or Low Temperature**

1. Select three local cities and enter them where indicated on the chart.
2. Select one of the time slots (5 p.m./6 p.m.) to watch for the five days.
3. Record the high or low temperatures for the three cities as given by SKYMAX Weather Chief Meteorologist, Jeff Lawson.
4. Calculate both the range and the mean for each city and among the three cities and enter the data.

**Today's High or Low Temperature**

Time Slot: _____	M	T	W	Th	F	Total	Range	Mean
City 1: _____	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
City 2: _____	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
City 3: _____	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Total	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>		
Range	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>			
Mean	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>			

**SKYMAX Weather Sheet****HOME CONNECTION  
EXERCISE 2****Learner Objectives:**

- Number sense and numeration
- Statistics (range and mean)
- Patterns and relationships (rows and columns)
- Listening, reasoning, and comprehension

**Computations:**

- Calculate the range by subtracting the lowest temperature from the highest temperature.  
(Performed by students in Grades K-4 and 5-8.)

**Directions: Actual (Outdoor) School Temperature**

1. Select one of these weeks: February 2–6 OR February 9–13.
2. Begin this exercise on either Monday, February 2 or Monday February 9
3. Locate a thermometer at school that can be used to measure the outdoor temperature.
4. Establish a time that corresponds with morning (e.g., 9:00am) and afternoon (e.g., 2:00 pm).
5. Each day for five days, check the temperature at the established times and record the actual (outdoor) temperature where indicated on the chart. (Make sure to record the temperature each day at the same time.)

**Directions: Jeff Lawson's Forecasted Temperature**

1. Watch the **6:00pm** SKYMAX Weather report on WVEC Channel 13 for five days (Monday-Friday) during the selected week (i.e., the same week you will record the outdoor temperature at school.)
2. On Monday, SKYMAX Chief Meteorologist, Jeff Lawson, will forecast the next day's (i.e., Tuesday) morning and afternoon temperatures. Enter Jeff's forecasted temperature where indicated on the chart.
3. Determine the variance or difference between the Jeff's forecasted temperature and the actual (school) temperature for each of the five days and record your findings.

<u>Monday</u>	Forecasted Temperature	Actual School Temperature	Variance (+,- degrees)
Morning		<input type="text"/>	
Afternoon		<input type="text"/>	

<u>Tuesday</u>	Forecasted Temperature	Actual School Temperature	Variance (+,- degrees)
Morning	<input type="text"/>	<input type="text"/>	<input type="text"/>
Afternoon	<input type="text"/>	<input type="text"/>	<input type="text"/>

<u>Wednesday</u>	Forecasted Temperature	Actual School Temperature	Variance (+,- degrees)
Morning	<input type="text"/>	<input type="text"/>	<input type="text"/>
Afternoon	<input type="text"/>	<input type="text"/>	<input type="text"/>

<u>Thursday</u>	Forecasted Temperature	Actual School Temperature	Variance (+,- degrees)
Morning	<input type="text"/>	<input type="text"/>	<input type="text"/>
Afternoon	<input type="text"/>	<input type="text"/>	<input type="text"/>

<u>Friday</u>	Forecasted Temperature	Actual School Temperature	Variance (+,- degrees)
Morning	<input type="text"/>	<input type="text"/>	<input type="text"/>
Afternoon	<input type="text"/>	<input type="text"/>	<input type="text"/>



## EVALUATION FORM

## WHAT DID YOU THINK OF CONNECT: EARTH FROM SPACE?

Please take a few minutes to respond to the following questions.

School \_\_\_\_\_ School Division \_\_\_\_\_  
Grade Level/Subject \_\_\_\_\_ No. of students participating in program \_\_\_\_\_

	Not at all		Somewhat		To a great extent
1. The program was valuable to					
a. your students	1	2	3	4	5
b. yourself as a teacher	1	2	3	4	5
2. The written materials were valuable to					
a. your students	1	2	3	4	5
b. yourself as a teacher	1	2	3	4	5
3. The Home CONNECT exercise was valuable to					
a. your students	1	2	3	4	5
b. yourself as a teacher	1	2	3	4	5
4. The program met your expectations	1	2	3	4	5
5. Did you view the program					
a. live	Yes		No		
b. videotape	Yes		No		
6. What comments or suggestions do you have for the program?					

Thank you for your response.

Please fax evaluation form to: (757) 864-8835

or

Mail to:

Attn: W.B. Williams, Ed.D.  
NASA Langley Research Center  
Office of Education  
17 Langley Blvd. Mail Stop 400  
Hampton VA 23681-0001